DOCUMENT RESUME

ED 433 666 EC 307 411

TITLE	Universal Design: Ensuring Access to the General Education Curriculum.
INSTITUTION	ERIC Clearinghouse on Disabilities and Gifted Education, Reston, VA. ERIC/OSEP Special Project on Interagency Information Dissemination.
SPONS AGENCY	Special Education Programs (ED/OSERS), Washington, DC.
PUB DATE	1999-00-00
NOTE	10p.
CONTRACT	ED-99-CO-0026
AVAILABLE FROM	ERIC/OSEP Special Project, ERIC Clearinghouse on Disabilities and Gifted Education, Council for Exceptional Children, 1920 Association Dr., Reston, VA 20191-1589. Tel: 703-620-3660; Tel: 703-264-9449 (TTY); Tel: 800-328-0272 (Toll Free); Web site: <http://www.ericec.org>.
PUB TYPE	Collected Works - Serials (022) -- Information Analyses (070) -- ERIC Publications (071)
JOURNAL CIT	Research Connections in Special Education; n5 Fall 1999
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Access to Education; *Accessibility (for Disabled); Adults; Children; Computers; *Curriculum Design; Definitions; *Disabilities; Elementary Secondary Education; Research and Development; *World Wide Web
IDENTIFIERS	*Universal Design

ABSTRACT

This issue describes promising research and development in the use of universal design principles to ensure curriculum access. It defines universal design and describes the differences between universal design and assistive technology. The activities of the Center for Applied Special Technology, the National Center to Improve the Tools of Educators, and the University of Kentucky in applying the concept of universal design to cognitive issues are highlighted. Universal access principles for designing curriculum, which include focusing on big ideas, using conspicuous strategies, implementing mediated scaffolding, integrating strategies, providing judicious review, and providing primed background knowledge are listed. Tips for designing web sites for universal access, which include: (1) use high contrast backgrounds and text; (2) use Sans Serif fonts for text; (3) make liberal use of chunking; (4) avoid using italics; (5) make use of alt tags when using graphics; (6) avoid the use of frames; and (7) include scripts when using audio files, are also discussed. In sections titled "Views from the Field" and "State and Regional Perspectives," school districts and states share their experiences in providing universal access. (CR)

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ED 433 666

Universal Design: Ensuring Access to the General Education Curriculum.

Research Connections in Special Education
Number 5
Fall 1999

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
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Research Connections

in Special Education

This Issue

Number 5
Fall 1999

To meet IDEA's goal of access to the curriculum, teachers must provide useful alternatives in both curricular materials and instructional delivery. This issue describes promising research and development in using universal design principles to ensure curriculum access.

> *"As the developers of computer hardware and software recognize the benefit that can be derived from **all** individuals being able to use the same computer equipment and software applications, the concept of universal design in the development of new products becomes more accepted, and built-in access becomes more readily available."*
>
> *Richard Riley*
> *Secretary of Education*

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Universal Design

Ensuring Access to the General Education Curriculum

The *1997 Reauthorization of the Individuals with Disabilities Education Act* (IDEA) calls for providing the greatest possible access to the general education curriculum as a means for improving educational results for students with disabilities. However, as **Nancy Safer**, Executive Director of the Council for Exceptional Children stresses, "One size does not fit all."

Students with disabilities—whether physical, emotional, sensory, or cognitive—may respond to the curriculum differently from other students. The foundation of curriculum access for all students is the design of educational materials, the primary tools used to teach curricular content.

Students may need accommodations made to the standard curricular materials. If they do not receive needed accommodations, their access to essential aspects of the curriculum may be blocked. To meet the goal of access to the curriculum for everyone, teachers must adjust the materials and their presentation to break down barriers and assist these students in learning. Ideally, a curriculum should be able to be modified or customized to meet the needs of both teacher and student. Unfortunately, teachers who have to work with standard, off-the-shelf curricular materials usually have little time to develop accommodations for their classes.

"As general education classrooms become more inclusive, strategies for providing access to the general education curriculum are needed so that students with disabilities are actively involved and progress within the curriculum in these classrooms. OSEP is committed to identifying effective strategies that support student access," points out **Lou Danielson**, director of the Research to Practice Division, in the U.S. Department of Education's

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CEC IDEAs that Work U.S. Office of Special Education Programs ERIC

Development funded by U.S. Office of Special Education Programs

Universal Design (continued from page 1)

Office of Special Education Programs (OSEP).

The research base on best approaches to providing curriculum access is in its infancy, but with OSEP support, useful findings are beginning to emerge. Universal design is one practice that shows promise for increasing access to the general education curriculum.

Defining Universal Design

The concept of universal design originated in architectural studies where considerations of physical access for individuals with sensorimotor disabilities led to designs that incorporated assistive technologies and adaptations. The more common examples are curb cuts, ramps, and automatic doors. When universal design principles are applied to physical space layout, accommodations are built-in rather than added as an afterthought.

In terms of learning, universal design means the design of instructional materials and activities that makes the learning goals achievable by individuals with wide differences in their abilities to see, hear, speak, move, read, write, understand English, attend, organize, engage, and remember. Universal design for learning is achieved by means of flexible curricular materials and activities that provide alternatives for students with differing abilities. These alternatives are built into the instructional design and operating systems of educational materials—they are not added on after-the-fact.

While technology is not a requirement of universal design, it makes the creation and use of universally designed curricula much faster and easier. It allows teachers to adapt the curriculum more easily to meet a wide range of student needs.

Over the past few years, there has been a concerted effort in special education to promote curricular materials with built-in adaptations—particularly in digital media—that are flexible and customizable. According to **Skip Stahl**, researcher at the Center for Applied Special Technology (CAST), curricula should be designed to incorporate the prerequisites of learning: Information must be accessible, support for the development of skills must be available, and the learner must perceive the learning to be important. These prerequisites should be built into curriculum in the following ways:

- Provide multiple representations of the information being presented.
- Provide multiple or modifiable means of expression and control.
- Provide multiple or modifiable means of motivating and engaging students.

The widespread availability of digital materials and sophisticated, rapid computer networks has made integrating these principles into curricular formats possible. Since everyone in the class is using the same materials, universal design avoids the stigma to which students with disabilities may be subjected if they use materials that differ from those used by the other students.

Wiggleworks, an early literacy program from Scholastic, offers an illustration of how these design features are utilized (for more information, visit the Scholastic web site at: **http://www.scholastic.com/wiggleworks/index.htm**). Students read stories and respond to activities in the reading program. All of the text can be enlarged, changed in color or highlighted, or read aloud by the computer. Children can navigate the software's learning activities via mouse or keyboard. A single switch can turn on a built-in scanning feature. *Wiggleworks* activities also offer a variety of options for expression, such as writing, drawing, and recording. When in "Write," students can begin a composition by typing text, by recording themselves speaking or drawing, or by placing words from a word list into their text.

Universal Design

Universal design differs from assistive technology, which is designed to meet highly individualized needs, in the following ways:

- Assistive technology is specially considered for an individual student, whereas universally designed approaches may be used by a wide range of students with diverse learning needs.
- Assistive technology is used by a student to meet the expectations of a given curriculum, whereas universally designed approaches make the curriculum accessible to students with varying needs.
- Assistive technology generally is under the purview of special educators, whereas universally designed approaches are implemented by general education teachers.

Universal Design In Action

With OSEP support, two groups—the Center for Applied Special Technology (CAST) and the National Center to Improve the Tools of Educators (NCITE) at the University of Oregon—have been instrumental in applying the concept of universal design to cognitive issues. Other groups, such as the University of Kentucky, have continued to explore how technology tools can be designed for universal access. Here are their stories.

Building in Access Right From the Start

"Current textbook materials and teaching practices typically fail to effectively provide support that can be individualized for students who need help," explains **Bart Pisha** of CAST. With OSEP funding, Pisha and his colleagues are using universal design principles to develop and research a software tool and instructional approach that will improve cognitive access for students with special needs to the general education curriculum.

A focus of the project is refining the CAST-developed ULTimate Reader (Universal Learning Technology, **http://www.cast.org**). This software uses an electronic version of the textbook or materials that the teacher is already using, and provides a rich variety of highly flexible reading supports such as adding spoken voice and visual highlighting to the electronic text. It is designed to support students as they learn about social studies from textbooks and the World Wide Web. This support is scaffolded—that is, it is gradually reduced as students develop more independence in the curriculum.

Pisha and his colleagues also are creating features for the ULTimate Reader that will support students as they identify patterns in text, develop effective strategies, and learn to sustain motivation and effort. They are creating text layouts that are clearer and easier to understand. "We have tried to integrate into the software strategies that make the content patterns more evident, build in strategies for comprehension, and make the presentation of information less intimidating and more engaging," Pisha describes. Among the many accommodations are highlighting words, phrases, and paragraphs to help readers focus on text; controlling speed of presentation; changing size of text; offering advanced organizers; providing definitions; allowing text to be read out loud; and changing the gender of the voice.

Wakefield, MA Goes Digital

Pisha and his colleagues are working with students and teachers at Wakefield High School in Massachusetts. Pisha chose a social studies text that was difficult for students with limited reading skills. With the blessing of the publisher, the text was digitized and loaded into the ULTimate Reader program. From there Pisha and his colleagues began studying how students interacted with the new features.

The goal is to develop and test the new features of the ULTimate Reader software with consumer input. "It is important to get input from potential users during development so that we can make the technology more usable and better address student needs."

One of the resource room teachers who are providing consumer input is **Terry Fuller**. "It really changes the way that students learn material," Fuller tells us. For example, the technology changes the traditional practice of having students answer questions at the end of the chapter. With the text in digital form, students can simply drag and drop whole paragraphs for use in their answers. Or, they can access definitions by hitting a key. Fuller says this raises issues about how teachers teach. "As teachers, this challenges us to have students go beyond tasks that can be mechanically handled by the computer and engage them in more higher level thinking activities."

Although it is too early in the development process to ascertain student outcome results, teachers and students alike give the universally designed approach high marks. For one, Fuller sees the effort as supporting Massachusetts State learning standards. For example, students who cannot read the book can gain the information, and students who cannot write legibly can communicate.

Implementing Universally Designed Technology in the Classroom

Pisha and his colleagues also have studied what it takes to get universally designed technology into classrooms. With OSEP funding, they recently undertook a study of how teachers integrated *Wiggleworks*—an early literacy software program that has many universally designed features.

Here are several tips:

- Teachers' technology skills must be relatively well developed and supported with ongoing opportunities for learning.
- There must be a clearly defined, but flexible curriculum in place.
- In-house staff must be available to keep computers functioning.

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Universal Design In Action (continued from page 3)

- The software and instructional materials must be compatible with both the curriculum and with the range of existing student needs.
- Staffing must be available to provide instructional supervision to the students working on the computers.
- Teachers must be provided with adequate time and access to resources to prepare new or modified materials.

In addition, **Joanne Collins Russell**, principal at Jackson-Mann Elementary School where Pisha conducted his study, points out that the principal's role is key. "Because we are talking about an innovation that is applicable to all students and all teachers, there must be commitment by the principal." Russell encourages principals to allot time for the staff to think through what universal design means in relation to children, but also in relation to teaching.

Ensuring Universal Access to the Curriculum

"Simply providing physical access to general education does not ensure that students with disabilities will gain cognitive access to the content of the curriculum," stresses **Ed Kame'enui**, researcher at the University of Oregon. "To gain cognitive access to the general education content, attention must be given to the architectural requirements of that content."

For Kame'enui and his colleagues at NCITE, there are 6 principles that should form the foundation for effective curriculum design (see sidebar). "These principles provide teachers with a blueprint for designing and developing cognitive supports to ensure universal access to the curriculum," Kame'enui points out.

According to **Doug Carnine**, director of NCITE, few commercially available curricular programs are designed carefully or systematically enough to enable students with disabilities to realize their potential or achieve acceptable levels of performance in the general education curriculum without extensive effort on the part of the teacher. "The principles advocated by NCITE offer a starting point to assist general educators in their efforts to provide cognitive access to all students." Both Carnine and Kame'enui believe that knowledge of these design principles will help teachers evaluate the adequacy of the architecture of instructional materials prior to adoption, and will be used to modify curricular and instructional materials.

The mission of NCITE is to assist publishers in developing high quality tools and to assist the marketplace in demanding high quality tools. As part of his NCITE responsibilities, Carnine advocates for publishers to recognize and address these principles in programs prior to publication. One advocacy strategy is to influence state policymakers to include universal access in their adoption decisions. "States have great influence over what is published—specifically textbooks—because of their purchasing authority," Carnine explains. California is an excellent example of how state policies can help institutionalize universal access.

The California Reading Initiative

In 1996, the California Reading Initiative began a major restructuring of how reading is taught in K-12 schools. This was a statewide attempt to disseminate and foster teaching practices drawn directly from research and resulted in a curriculum framework for reading and language arts in California. NCITE consulted with California educators as they developed their reading and language arts framework.

In 1999, the Special Education Literacy Task Force issued a report detailing how the initiative addressed issues germane to special education. **Marion Joseph**, California State Board of Education member and chair of the Task

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Universal Access Principles for Designing Curriculum

- **Big Ideas**: Concepts, principles, or heuristics that facilitate the most efficient and broad acquisition of knowledge.
- **Conspicuous Strategies**: Useful steps for accomplishing a goal or task.
- **Mediated Scaffolding**: Instructional guidance provided by teachers, peers, materials, or tasks.
- **Strategies Integration**: Integrating knowledge as a means of promoting higher-level cognition.
- **Judicious Review**: Structured opportunities to recall or apply previously taught information.
- **Primed Background Knowledge**: Preexisting information that affects new learning.

Universal Design In Action (continued from page 4)

> *"The framework, which is designed for **all** students, including those with special needs, provides guidance for selecting quality materials that integrate effective instructional design principles."*
>
> *Catherine Barkett*
> *Administrator of Curriculum Frameworks and Instructional Resources, California Department of Education.*

Force, said, "There are huge reforms in reading taking place—but too often, children with disabilities have not been considered part of reforms—this is not the case in California." An important concept contained in the framework is the need to provide universal access for all learners. "Universal access provides a way to ensure that all students receive effective, research-based instruction in learning how to read," Joseph explained.

Kame'enui, one of the principal authors of the California framework, pointed out that it was important to embed universal access principles for designing beginning reading curriculum for diverse learners in the framework. "The content of this framework is designed to provide a road map for designers and developers of instructional materials. The entire framework will be used to develop specific criteria for the adoption of instructional materials. One such criterion is universal access, whereby materials are designed to maximize the learning of all students, including students in special education."

Designing Web Sites for Universal Access

The Internet may be the most significant educational technology of the twentieth century. The Internet is not only a reference resource, it also is a communications vehicle and multimedia presenter that enhances learning opportunities for students. So how can we ensure that web sites are designed for universal access?

Edward Blackhurst and his colleagues at the University of Kentucky are in the process of developing a prototype for a series of web-based tutorials on the IDEA 1997 Amendments and its regulations. "Early on, we were quite concerned with accessibility of web sites," Blackhurst explains. "We wanted to accommodate individuals who use screen readers that convert text to synthesized speech, those who require enlarged type, and those who are unable to access audio files." Subsequently, Blackhurst began exploring the barriers that individuals with such needs encounter when attempting to access information on the web.

Following are some of the design specifications that Blackhurst and his colleagues adopted to guide their development work to ensure universal accessibility of the web site.

- **Use high contrast backgrounds and text.** Some individuals have difficulty reading screens that use certain color contrasts (e.g., red text on blue background) or that use inverse text. Black or blue text on white backgrounds generally works well.
- **Use Sans Serif fonts for text.** Letters with serifs are difficult to read on screen and can create visual fatigue when large amounts of text are included on web sites. Examples of font families that tend to work well on web pages are Verdana, Arial, and Geneva.
- **Make liberal use of chunking.** Large text passages on the screen can cause visual fatigue. Chunk text by making short paragraphs, using different levels of subheads, and placing bullets and block-indented paragraphs in strategic locations.
- **Avoid using italics.** Italics are difficult to read on the screen. Use boldface in place of italics if emphasis is required.
- **Make use of alt tags when using graphics.** Information in graphics cannot be read by screen readers unless special codes are used when placing graphic images such as photos or navigation buttons on web pages. Alt tags let you describe the graphic—e.g., "A picture of the U.S. Senate Building," or "A right arrow. Click it to move to the next screen." An individual using a screen reader will be able to hear the description.
- **Avoid the use of frames.** Many web sites contain two scrolling fields (called frames) next to each other (e.g., table of contents down the left side, narrative on the right side). Frames pose problems for individuals who use screen readers because the reader reads across the entire page, from left to right.
- **Include scripts when using audio files.** Scripts that contain a textual narrative of the audio messages should be made available as an optional way to acquire the information.

Views From the Field

We are only beginning to understand the potential of universal design for helping students with disabilities to access the general education curriculum. Following are perspectives from the field.

A District Takes on Universal Design

The Concord School District in New Hampshire has embarked on a long-term project to infuse technology into classroom practice. One of the models that educators are using to plan for students with disabilities is universal design. Concord's goal of universal access is centered on using technology to make the curriculum accessible to all students. To reach this goal, the district provides adaptations of print materials, integrates technology that is universally designed, and supports teachers in adapting the curriculum with these technologies. According to Concord School District Special Education Coordinator **Donna Palley**, "Through the universal design project, special needs students will have tools to enhance their communication skills and participate in the general education curriculum."

Providing this level of access requires Concord to convert all of its curriculum materials to digitized form. Electronic access to the materials is the most important prerequisite to using technology and universally designed curriculum. Palley tells us that "Curriculum materials that are digitized and available on the computer can be manipulated to meet a variety of learning needs." For example, with digitized materials, students who need help can get it by:

- Enlarging the size of the text.
- Changing the font or color of the text.
- Having the entire text or parts read aloud.
- Using a switch and computer to access a text.

Currently, the district has approximately one dozen scanners—one of which is high speed—along with a cadre of volunteers who help out with the scanning of printed materials and texts into digital format. Once the text is available in digital format, the material is stored on Concord's server, ready to be downloaded anywhere in the school district.

Access For What?

Materials are only as good as the pedagogy on which they are based and the way they are used by teachers and students. "Applying the principles of universal design to the development of curricular options for all students is one of the most promising and exciting movements on today's educational scene," reports **John Langone**, professor of special education at the University of Georgia and the 1998-1999 president of the Technology and Media Division of CEC. "Any pitfalls of universal design are not a function of universal design, per se, but may be a function of where we as educators place our emphasis in developing curriculum."

For Langone, problems often arise when, in our enthusiasm to implement a new tool or materials, we inadvertently overlook the need to identify what is important for students with special needs to learn. "We need to look at the content of what students are learning and decide if, in fact, it is worth learning."

For example, Langone points out that many instructional tools fall short of helping students to develop knowledge and learn skills that will lead to their becoming independent workers and enjoying a high quality of life. "Many of the materials available today suffer from the same problems inherent in most textbooks, that is, they are simply text based with some supporting images," Langone explains. "Universal design of poorly conceived materials is not going to result in better outcomes for youngsters."

According to Langone, educators should conceptualize and develop curricula rich in functional information, and then look to universal design principles when presenting it. "This information would be presented in multiple formats to allow students many forms of expression, and to encourage student engagement with materials in a variety of ways." Key features that are helpful to a large range of students with differing abilities include:

- Providing text in digital forms.
- Including captions for all graphic representations and images.
- Using powerful video anchors that include descriptions of what is being viewed.
- Building adaptations that assist learners in identifying the important information.

LINK-US is an OSEP-funded project at the Education Development Center that features case studies of schools using innovative technology solutions. Concord School District was featured in a recent on-line course. For more information on LINK-US, contact ***Elaine Crowder*** *at:* ***ecrowder@edc.org****.*

State and Regional Perspectives

Universal design shows promise for supporting many state and regional initiatives.

Supporting State Outcome Goals in Maine

In Maine, the Learning Results—which has been accepted by the Maine Legislature—are the results that all students are expected to achieve. According to **Kathy Powers** of the Maine Consumer Information and Technology Training Exchange (MaineCITE), a project of the Maine Department of Education, universal design is an important component in developing strategies and techniques for identifying and circumventing barriers in existing curriculum materials and delivery methods.

"Using technology to increase the accessibility of the curriculum itself shifts the responsibility for change from the individual to the learning environment," Powers tells us. "The ultimate goal of these efforts is the creation of accessible, inclusionary classrooms." MaineCITE has identified universal design as a viable strategy to help all Maine students achieve high standards under the Learning Results initiative.

As might be expected, Maine's Learning Results initiative is having a significant effect on the professional development of teachers. Powers and her colleagues have been working to make universal design part of teacher professional development opportunities. "If we are going to include all students in standards-based reform, an understanding of universal design concepts must be part of this professional development," Powers explains. "From a state perspective, this means being able to capitalize on the resources already in place and integrate this new initiative into an existing one."

In an effort to institutionalize universal design concepts, MaineCITE is collaborating with the Maine Educational Center for Assistive Technology and Software (MECATS) at the University of Southern Maine. Funded in part by OSEP, MECATS provides educators and parents with information, training and technical assistance with assistive technology—and more recently, universal design. The goal for MaineCITE is to incorporate universal design into MECATS' ongoing inservice work, both within school districts and among colleagues in institutions of higher education.

Libby Cohen, director of MECATS, describes current activities as being focused on inservice educators. Teams from local school districts are trained in universal design concepts. They are given software to use that incorporates universal design principles. In addition, teams are expected to design their own lessons and curricula using universal design principles over the course of a year.

Increasing Access to Universities in Oregon

The Northwest Center for Technology Access was developed to assist the State of Oregon and the region in meeting the challenges imposed on individuals with disabilities by the rapid infusion of information technologies into all aspects of society. According to Center Coordinator **Ron Stewart**, the primary purpose of the center is to promote universal access to technology by individuals with disabilities and to develop and promote cost effective, efficient, and systemic solutions to meet the goal of anytime, anywhere technology access. Stewart's goal is to increase the number of individuals with disabilities who attend the university. He believes this will happen with improved services. "Modern information technologies inherently present some very significant challenges for individuals with disabilities," Stewart points out, "but these challenges can be overcome."

Universal access to information is a part of Oregon State University's ongoing commitment to establishing a barrier-free learning community. As such, the university has developed a set of physical accessibility guidelines for software, hardware, and web sites (you can review copies of these guidelines at: **http://www.orst.edu/dept/is/**).

According to Stewart, new technologies pose additional challenges. One such technology is distance education, which is being increasingly used at universities, as well as by states to disseminate coursework and training programs. "The complexity of distance education makes providing accessibility a challenge," says Stewart. For example, access issues must be considered for the following areas:

- **Site accessibility**. All aspects of the site facility must be accessible, including architectural considerations (e.g., ramps).
- **Technological accessibility**. Any tools required by participants must be accessible (e.g., magnification systems and optical scanning systems that allow a user to access printed information).
- **Program accessibility**. In addition to the actual broadcast program, this includes accessibility of all web sites pages, video workbooks, and session materials used in the session.

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BOBBY v3.1 APPROVED

Is your web site Bobby approved?

CAST provides a service to web page designers called Bobby. Bobby will scan a web page and determine if anything on the page is nonaccessible. Web pages that pass Bobby's scrutiny are allowed to display the Bobby "stamp of approval." You can find out more about the web page accessibility tester at: **http://www.-cast.org/bobby**

Research Connections *is a biannual review of research on topics in special education, focusing on research sponsored by the U.S. Office of Special Education Programs.*

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Developed by Warger, Eavy & Associates for the ERIC/OSEP Special Project. The ERIC/OSEP Special Project is operated by The Council for Exceptional Children through the ERIC Clearinghouse on Disabilities and Gifted Education. **Research Connections** *was prepared with funding from the U.S. Department of Education, Office of Special Education Programs, under contract no. ED-99-CO-0026. It is in the public domain and may be freely reproduced and disseminated. The opinions expressed here do not necessarily reflect the positions or policies of OSEP or the Department of Education.*

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